A rough estimate of the energy liberated by the fire can be readily made. A given weight of oil will raise the temperature of one thousand times its own weight of water through 10° C. The fire of 6,000,000 barrels, assuming a barrel to be half a cubic meter, is equivalent to the burning of 3.10^9 kilograms and would produce 3.10^{13} kilogram calories; taking the specific heat of air to be 1/4, we find that this would heat 12.10^{12} kilograms of air through 10° C. This amount of air is about 10^{13} centimeters, or 10^4 cubic kilometers.

If there were no wind initially, then if we assume that 10^4 cubic kilometers of air is removed through a funnel vertically over the fire, this amount of air must drift in sideways to the zone of the fire, and be replaced by air pushing in from further distances. Taking the zone of fire to be a circle of 1 kilometer radius, this involves the convergence to the edge of the zone of fire of air from 50 kilometers away. The angular momentum of this air remains constant, in space, and if the velocity in the whirl about the fire be v at the edge of the fire (at 1 kilometer from the center) we then have

$$(50)^2 \, \omega \sin \phi = 1. \, (v + \omega \sin \phi).$$

Thus $v =$ approximately $(50)^2 \, \omega \sin \phi$.
    $= 2,500 \times 5.7 \, 10 - {}^5$ kilometers per second.
    $= 142$ meters per second.

Thus the whirl formed in still air would have a whirling velocity of 142 meters per second at 1 kilometer from its center, with velocity decreasing outward in inverse proportion to distance from the center.

In the case in question, the air was not initially still, and so the ascending cylinder of air was replaced by a sheet of air, and the one whirl was replaced by a number of smaller whirls. Enough has been said, however, to show that the supply of energy available from the fire was ample to account for the formation of violent tornadoes without assuming any special properties of the wind distribution. Moreover, it has been assumed above that only air heated through 10° C. will ascend, whereas it is certain that in the region of such a fire as this air heated through a much smaller range of temperature would ascend readily. If we decrease the necessary range of temperature we increase the volume of air removed by convection in inverse proportion, and increase the intensity of the whirl in proportion to the mass of air removed.

It may be recalled that during the fires which completed the destruction of Tokyo after the earthquake of September 2, 1923, Doctor Fujiwhara reported the formation of a number of whirls.[1]—*D. Brunt.*

METEOROLOGICAL SUMMARY FOR SOUTHERN SOUTH AMERICA, DECEMBER, 1926, AND ANNUAL SUMMARY FOR 1926

By J. B. NAVARETTE, Director

[Observatorio del Salto, Santiago, Chile]

During December, atmospheric changes were largely limited to the southern part of the country, while the weather was more settled in the Central Zone.

On the 1st a depression crossed the far south, causing rain up to Arauco. Between the 2d and the 5th an anticyclonic center overlay the southern area, causing general fine weather. On the 6th began an important period of bad weather, which culminated on the 13th with a heavy rainstorm that extended as far north as the Province of Talca in the Central Zone. The maximum precipitation was recorded on the 12th at Valdivia, 63 millimeters.

From the 14th to 18th, pressure rose in the south, and general fine weather was the rule.

On the 19th and 20th a moderate depression lay off Punta Tumbes, and caused rains between Maule and Valdivia.

The 21st, anticyclonic conditions reestablished themselves in the south and dominated the situation until the end of the month, causing in the Central Zone general fine weather, southerly winds, and high temperature.

ANNUAL SUMMARY, 1926

The meteorological year 1926 was one of the rainiest of record in the Central Zone from 1873 to date. The period of most intense atmospheric circulation was included between May 20 and July 13. Between these dates occurred almost the entire year's rainfall. June was the rainiest month. Total precipitation for the year reached [an average in the Central Zone of] 824.1 millimeters.—*Transl. B. M. V.*

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[1] Meteorological Magazine, December, 1923, p. 247.

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C. FITZHUGH TALMAN, in Charge of Library

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